Chapter

6

Azure Pricing, Service Levels, and Lifecycle

MICROSOFT EXAM OBJECTIVES COVERED IN THIS CHAPTER:

DESCRIBE AZURE COST MANAGEMENT AND SERVICE LEVEL AGREEMENTS

✓ **Describe methods for planning and managing costs**

- Identify factors that can affect costs (resource types, services, locations, ingress and egress traffic)

- Identify factors that can reduce costs (reserved instances, reserved capacity, hybrid use benefit, spot pricing)

- Describe the functionality and usage of the Pricing Calculator and the Total Cost of Ownership (TCO) Calculator

- Describe the functionality and usage of Azure Cost Management

DESCRIBE AZURE COST MANAGEMENT AND SERVICE LEVEL AGREEMENTS

✓ **Describe Azure service level agreements (SLAs) and service lifecycles**

- Identify the purpose of an Azure service level agreement (SLA)

- Identify actions that can impact an SLA (e.g., Availability Zones)

- Describe the service lifecycle in Azure (Public Preview and General Availability)

Previous chapters have explored the fundamentals of services and solutions in Microsoft Azure. This chapter explores the mechanisms by which you purchase Azure services and manage costs, take advantage of service level agreements, and work within the Azure services lifecycle.

First, let's explore how you purchase Azure services.

Purchasing Azure Services

As you learned in Chapter 2, "Azure Core Services," Azure subscriptions are the mechanism that gives you access to Azure services. Various types of subscriptions offer different capabilities for purchasing Azure services. The following section explains these options.

Azure Subscriptions

Microsoft provides free and paid subscriptions for Azure services. These include the following:

- **Free trial:** This type of subscription provides 12 months of select free services and credit to use any Azure service for 30 days. These services are disabled when the 12-month period ends or when your 30-day credit expires. You can convert the free subscription to a paid subscription.

- **Pay-as-you-go:** With this type of subscription, you pay for services as you consume them. The subscription can be tied to a credit card or debit card, or you can use prepaid invoicing to gain access to volume discounts.

- **Member offers:** Some Microsoft products and services, such as Visual Studio and Microsoft Partner Network, provide credits toward Azure services.

Which subscription type you choose depends on your consumption scenario and other factors. For example, you might start with a free subscription to test Azure features and gain an understanding of Azure, and then convert it to a pay-as-you-go subscription when you are ready to start deploying Azure resources in earnest.

> Keep in mind that you are not limited to a single subscription. You can have any number of Azure subscriptions, each containing various resources and services as needed. Using multiple subscriptions can be useful for helping allocate costs across your organization.

Purchasing Services

Subscriptions enable you to access Azure services, but they do not in themselves provide the means to purchase Azure services. You have three options for purchasing Azure services:

- **Enterprise Agreement:** Enterprise customers often purchase Microsoft licensing and services through an enterprise agreement (EA). EAs are generally three years in length and invoiced annually, although customers can purchase multiyear agreements and pay for them up front. An EA offers the flexibility to "true up" licensing annually and generally includes incentives to help reduce costs. EAs are negotiated with Microsoft and fulfilled through a third-party licensing partner.

- **Web Direct:** With this method you purchase Azure services directly through the Azure portal. Services are billed monthly to a credit card or through invoicing, depending on which method you establish when you create the subscription.

- **Cloud Solution Provider (CSP):** CSPs are Microsoft partners that specialize in helping their clients deploy and manage cloud services.

Choosing the right mechanism to purchase Azure services is an important consideration. For example, if your organization already has an EA, then it likely makes sense to include your Azure expenses in your EA through incentives and other potential discounts or investments that Microsoft agrees to make for your EA term.

Purchasing through a CSP also adds points for consideration. When you use a CSP, the CSP is responsible for your Azure support. If you have a break-fix issue, rather than contact Microsoft you contact your CSP. The CSP is then responsible for working to resolve the issue either directly or through Microsoft support channels. If you currently have a Premier or Unified Support agreement with Microsoft and are used to getting your support directly from Microsoft, the CSP's required involvement will be an operational change for you. However, even if you purchase Azure services through a CSP, you can still purchase a Premier or Unified Support agreement with Microsoft and use that for your on-premises and hybrid issues. Work with your Microsoft Customer Success Account Manager (formerly known as Technical Account Managers, or TAMs) to determine what support options you have directly with Microsoft when you also have a CSP in place.

Factors Affecting Cost

Many factors influence the cost of Azure services, and understanding these factors can help you reduce and control costs. For example, some services offer different tiers of service, with storage being a good example. The type of storage, performance tier, and access tier

all affect cost. Moving from one type of storage to another can cause a significant increase in cost. Before deploying an Azure service, make sure you understand the service tiers and other factors that affect that service's cost.

Regardless of which services you deploy in Azure, you can track service usage with usage meters that Azure creates automatically when you deploy a resource. Azure uses the data generated by the usage meter to determine what to bill you at the end of each billing period. For example, assume you stand up a virtual machine in Azure. Azure tracks CPU time, incoming and outgoing network traffic, disk usage and read/write operations, and the time a public IP address is associated with the virtual machine. All of these are billable items that determine the overall cost in that billing period for the VM. If you turn off the VM, it generates no resource usage and therefore no cost other than for storage. Because the storage persists, you will continue to incur storage costs, even when the VM is off.

Usage captured by each usage meter results in a certain number of billable units, and those billable units are converted to charges based on resource type. One billable unit for a particular service will be different in value from the value of a billable unit for another service.

> Resource allocation and uptime are key aspects of Azure cost management. If you are using a resource, you are getting billed for it (unless you are using a free subscription). As described earlier, VMs are a good example of where shutting down resources when not needed will have a major effect on cost. Likewise, leveraging serverless offerings such as Azure Functions that incur costs only when they are running and using resources is a great way to minimize costs.

Another potential way you will incur costs in Azure is by purchasing solutions or services from the Azure Marketplace. These services and solutions are provided by third-party vendors and billed by those vendors. Before you purchase a service or solution from the Azure Marketplace, be sure to investigate and understand the recurring cost associated with the offering.

Where you deploy Azure resources also affects costs. You must specify a region when you create a resource, and although regions enable you to locate resources nearest to where your users will consume them, the regions potentially have different costs. So, where you deploy a resource can determine the costs for that resource.

Network traffic is also a consideration for cost. Network traffic flowing into an Azure data center is free. Network traffic flowing out, however, has a cost associated with it. For example, assume that to save on expenditure you place Azure resources in a region that has a lower cost. However, you need to perform data transfers on a periodic basis from that region to another. The cost associated with that outgoing traffic could offset the cost savings you achieved by placing the resources where you did.

Data transfer cost between regions depends on the region and location. There is one cost within a region and a higher cost when going from a region on one continent to a region on

another continent. Data transferred through Internet egress routed through the Microsoft Premium Global Network or through the Routing Preference Standard Tier also have differing costs. The bottom line is that you need to carefully consider ingress and egress traffic costs when determining where to place your Azure resources.

Billing Zones

A billing zone is a geographical grouping of Azure regions for billing Azure resources. For example, Zone 1 includes (among other regions) Australia Central, West US, East US, Canada West, West Europe, and France Central.

   The key point to understand about billing zones is that network traffic flowing between regions and across billing zones has a different billing rate depending on the source and destination of the traffic. As you work to determine where to place your Azure resources, keep this factor in mind to minimize costs where possible.

> You will find more information about billing zones at `https://azure.microsoft.com/en-us/pricing/details/bandwidth`.

   Now that you have some background in how to purchase Azure services and how they are billed, let's look at how you can plan and manage costs in Azure.

Planning and Managing Azure Costs

Microsoft offers several resources to help you plan your Azure implementation and minimize costs as much as possible. The following sections explore these resources.

TCO Calculator

The Total Cost of Ownership (TCO) Calculator for Azure enables you to estimate the cost of operating your IT services and solutions in Azure over time compared to your current on-premises costs. Total cost of ownership seeks to include obvious costs as well as sometimes less tangible costs. These include, for example, electricity, cooling, and other facilities costs, as well as licensing, hardware, and labor, among others. Figure 6.1 shows the TCO Calculator.

> Visit `https://azure.microsoft.com/en-us/pricing/tco/calculator` to access the TCO Calculator.

FIGURE 6.1   Estimate Azure costs with the TCO Calculator.
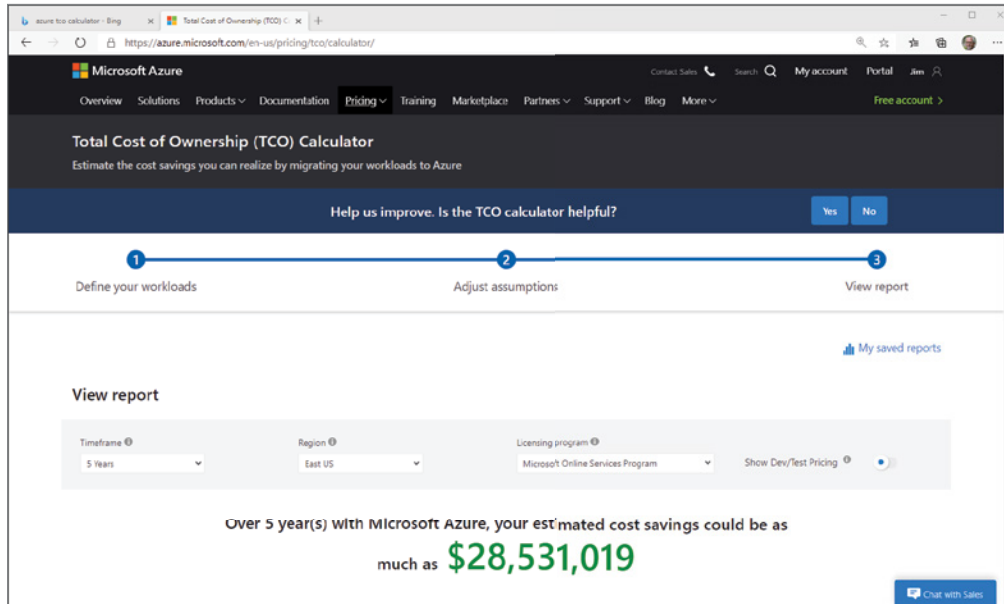
The first step in estimating costs with the TCO Calculator is to define your on-premises workloads in the categories of servers, databases, storage, and networking. Next, you provide information about your current on-premises licenses and whether they are enrolled in Software Assurance (SA), which is a benefit of a Microsoft Enterprise agreement. If they are enrolled in SA, you can potentially save money by reusing those licenses in Azure.

With your workloads and licensing defined, the next step is to adjust assumptions in the calculator. For example, you adjust the rate you pay for electricity per kilowatt hour, the hourly rate for IT staff, maintenance costs, and other factors. The TCO Calculator applies those adjustments and gives you a suggested cost savings. You can then download, share, or save the report.

The TCO Calculator obviously cannot provide exact costs because your assumptions are just that—assumptions. However, the TCO Calculator can provide a "directionally correct" estimate of how moving workloads to Azure can affect the costs of deploying and maintaining those workloads in Azure compared to your current solution. The TCO Calculator will not give you an exact cost for all your workloads, but it will give you a first look at Azure pricing overall and help you decide what magnitude of cost savings you will experience by moving to Azure.

> You do not need an Azure subscription to use the TCO Calculator.

Pricing Calculator

When you need a more refined cost estimate for specific workloads, you can turn to the Pricing Calculator. With the Pricing Calculator, you specify the Azure products that you want to include in a pricing estimate. For example, assume you want to price a simple web application that requires six VMs, storage, and two Azure SQL Database instances. The Pricing Calculator can give you the operational costs for all of those resources to help you understand the cost of standing up that specific solution in Azure.

When you first open the Pricing Calculator, you will see a list of products, as shown in Figure 6.2. Begin building your estimate by selecting the resources that comprise the solution. Using the earlier example, click Virtual Machines to add VMs to the solution. Then add Azure SQL Database and Storage Accounts in the same way. The Pricing Calculator adds them below, as shown in Figure 6.3.

FIGURE 6.2 Begin in the Pricing Calculator by selecting the products to include in your solution.
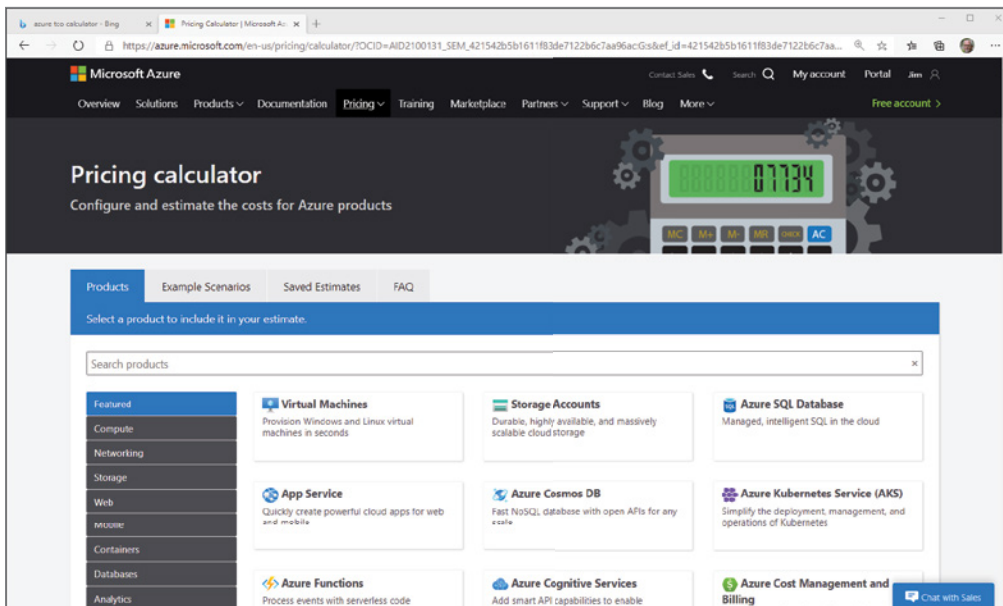
You now need to specify parameters for each resource. With the VMs, for example, you specify parameters such as the region, OS type, tier, number, and other values. As you modify parameters, the Pricing Calculator updates estimated costs for each resource. At the bottom of the page you choose support options, special programs and offers, and additional information to adjust the pricing. You can then export, save, or share the price for the solution.

FIGURE 6.3   Specify the options for each resource.

> As with the TCO Calculator, you do not need an Azure subscription to use
> the Pricing Calculator. You will find it at `https://azure.microsoft.com/`
> `en-us/pricing/calculator`.

Managing and Minimizing Azure Cost

It is easy to manage costs when you have only a few resources in Azure, but imagine how complex cost estimation and management becomes when you make the decision to move your entire data center into Azure and build a new disaster recovery solution to go along with it. Moving to Azure requires a mind shift from a capital expenditure (CapEx) model to an operational expenditure model. CapEx costs are relatively easy to calculate as a fixed asset, whereas operational costs based on consumption are more difficult. There are several things you can do to track and manage your expenses in Azure to ensure that your investment in Azure continues to result in cost savings for your organization. The following sections explore these topics.

Estimating Costs

As discussed previously in this chapter, Azure offers pricing tools that enable you to not only get an estimate of a large-scale deployment to Azure, but also get fairly accurate estimates for specific workloads or solutions. It is easy to deploy resources and solutions in Azure, to

the point where you might get into the mindset of simply deploying a solution without fully determining the cost beforehand. Even if you are working with a free subscription to test Azure, understanding the potential costs of a resource or solution is critical. So, turn to the TCO Calculator when you are considering a move to Azure, but be sure to use the Pricing Calculator before you deploy a new resource or solution, entering the values for a worst-case consumption scenario to make sure you understand the effect of deploying the service.

Monitoring Consumption with Azure Advisor

Estimating usage is certainly an important first step, but monitoring your Azure consumption is equally important to managing costs. Azure Advisor provides a means for you to track Azure consumption and offers recommendations not only for cost savings but also for performance, reliability, and security. Figure 6.4 shows an example of Azure Advisor, which you access through the Azure portal.

FIGURE 6.4 Use Azure Advisor to help manage costs.
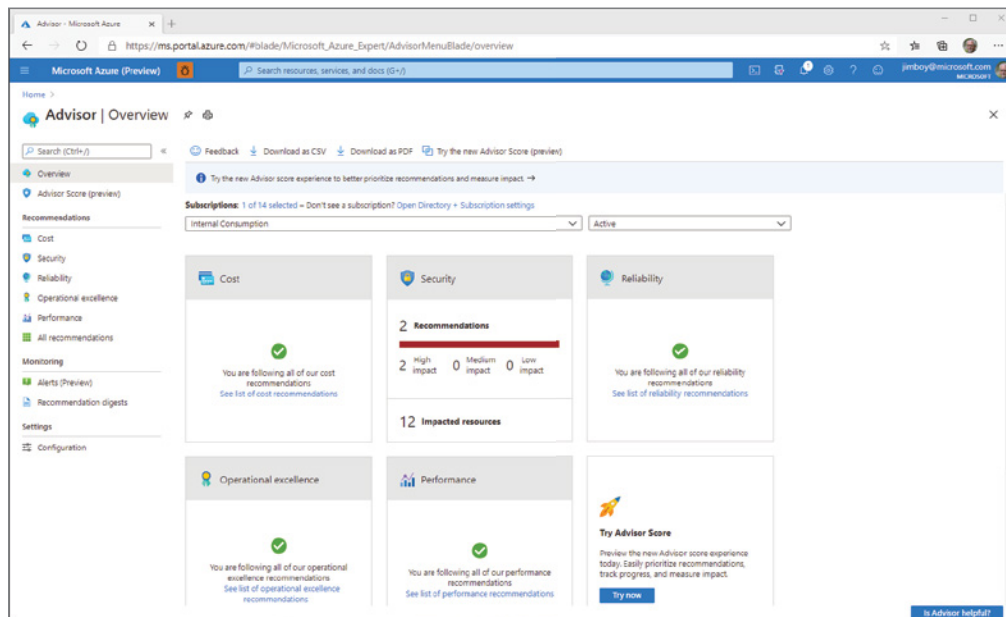
You can choose which subscription you want to view in Advisor, which then provides recommendations across several categories, including Cost. You can then click a category to view specific recommendations that Advisor offers based on usage telemetry and other factors.

Implementing Spending Limits

If you have a free trial subscription or credit-based subscription, Azure imposes limits automatically. If you have a credit-based subscription that gives you a certain value of services you can consume in a month, Azure shuts off your subscription when you reach the limit, then turns it back on at the beginning of the next billing cycle. For credit-based subscriptions with credits applied over multiple months, you can turn off the spending limit through the Cost Management + Billing service, discussed later in the section "Azure Cost Management + Billing." If you need to turn off limits for a free trial account, convert the account to a pay-as-you-go subscription.

Managing Subscription Limits (Quotas)

Many services in Azure have adjustable limits with a default limit that can be adjusted up to a maximum limit (also called a *hard limit*). These limits are also sometimes called *quotas*. If you are attempting to create a resource and receive a message that you must increase your subscription limits, this means you have hit the limit for that resource. With many resources you can increase the limit, not to exceed the hard limit. To increase a subscription limit, simply open a case online.

Prepaying with Azure Reservations

Azure Reservations enables you to save on Azure costs by reserving (prepaying) for resources. The cost savings can be significant, up to 70 percent or more. For example, you might prepay for an entire year on the VMs that you will be using to reduce cost or commit to an even longer period for greater savings. You can pay for a reservation up front for the specified period (such as a year) or pay the reservation monthly. The latter enables you to enjoy the cost savings of the reservation without a lump sum payment up front. There is no additional cost to pay monthly rather than lump sum.

You can use Azure Reservations with enterprise agreements, CSP subscriptions, and pay-as-you-go subscriptions. You will typically use the Azure portal to purchase a reservation, but you can also do so through Azure APIs, PowerShell, and CLI.

Choosing Less Expensive Regions

Regions potentially have different costs for the same resources compared to other regions. You can often save costs by placing resources in a less expensive region. However, you do need to consider factors such as closeness to your users, varying regulatory requirements, and network egress bandwidth. In general, you should place connected resources with metered bandwidth within the same region to avoid additional network egress charges.

Managing Resources and Billing for Cost Efficiency

Several other design and operational factors can have a significant effect on the overall costs of your IT services. For example, actively managing the number, size, and state of your VMs is a key mechanism for managing your VM costs:

- **Resize:** Periodically review VM sizing based on consumption, performance, and costs to determine if you can reduce the size of your VMs to save additional operational costs.

- **Turn off:** Ensure that VMs are turned off when not in use to avoid consumption charges when you do not need the VMs.
- **Delete:** If you are no longer using a VM, make any appropriate backups and then delete the VM.

> Effectively managing your VMs can have a significant impact on your Azure consumption costs, particularly if you use several VMs.

Moving from an IaaS model to a PaaS model can also have a major effect on your Azure operational costs. For example, if you are using SQL Server VMs today to provide SQL services for an application, moving to SQL Server for Azure or SQL Server Managed Instance could reduce costs because you are charged for your consumption of the database service, not the VMs that support it. Many other scenarios exist where moving from IaaS to PaaS can reduce costs, but consumption charges are just one aspect of these scenarios. Hosting services on VMs that could otherwise be moved to a PaaS offering means you must manage the VM operating systems, patching, and so on, which imposes an operational overhead that you eliminate by moving to a PaaS solution.

One final option for managing costs is using tags to identify resource owners for billing purposes. Assume, for example, that the marketing department has a set of resources deployed in Azure that your team manages for them. The marketing department is responsible for the operational costs associated with those resources. So, tagging their resources to identify them as marketing resources enables you to not only identify what their costs are but also use that information to cross-bill them or allocate costs to their cost center.

> You can apply tags when you create a resource or edit the tags after the fact. Use Azure Cost Management + Billing to view billing information, including tags.

Azure Hybrid Benefit

If your Windows Server or SQL Server licenses are covered by Software Assurance (SA), you might be able to reduce Azure costs when you move those workloads to Azure VMs. Azure Hybrid Benefit enables you to repurpose your perpetual licenses for these products for use in Azure VMs and gain a corresponding costs savings.

Spot Pricing

Another way to save on Azure costs is through spot pricing. Spot pricing enables you to take advantage of discounted pricing for resources that are not being used. With this model, you purchase VMs with the understanding that those VMs can be evicted from Azure with 30 seconds' notice when Azure needs those resources for other, non-spot workloads. You can configure the VMs to be either deallocated or deleted. If deallocated, the VMs are placed in

a stopped-deallocated state and can be redeployed later. However, there is no guarantee that the reallocation will be successful, considering that the VMs are subject to resource availability. Deallocated VMs continue to incur any storage costs associated with the VMs. If you configure the eviction policy to delete the VMs, those VMs are stopped and deleted and incur no additional costs. Spot VMs do not have SLAs.

Spot VMs offer a significant cost savings but are not appropriate for workloads requiring continuous operation or SLAs. Nevertheless, spot VMs can be particularly useful for dev/test systems or production systems running processes that can be interrupted.

> You have the option to set a maximum price for a spot VM, which gives you some flexibility to retain the VM until it essentially prices itself off the service and is evicted. You can also set the maximum price to –1, which prevents it from being evicted but also means it then potentially runs at standard cost rates. The VM's price is the current spot price or the standard VM price, whichever is less, provided resources are available to accommodate the VM.

Reserved Capacity

Another way to reduce costs in Azure is to use reserved capacity for Azure SQL Database and SQL Managed Instance. With reserved capacity, you make a commitment to either of these SQL services for a period of up to three years and receive a corresponding reduction in price. You specify the Azure region, deployment type, performance tier, and term for the reservation and receive pricing based on those factors. Once the reservation is in place, Azure SQL Database or SQL Managed Instances that you have running automatically receive the reserved pricing instead of pay-as-you-go pricing. Reservations do not automatically renew, however, and pricing reverts to pay-as-you-go pricing when the reservation term expires. You can then establish a new reservation.

Azure Cost Management + Billing

Azure Cost Management + Billing, as its name implies, combines cost management functions with billing functions to provide a single place where you can manage both in Azure. You access it through the Azure portal. Click Cost Management in the navigation pane to access the Cost Management tools.

Azure Cost Management uses analytics to report on costs and usage patterns in Azure. You can define budgets for your subscriptions and receive notifications related to expenses against budgets, schedule automated report distribution, and manage other features that enable you to understand consumption and spending in Azure.

Setting budgets on your subscriptions allows you to track expenses against those budgets and receive alerts as spending crosses thresholds that you set. This helps you identify changes, such as resizing resources or turning off unused resources, that you might need to make to avoid exceeding your budget.

Cost Management also provides cost analysis and forecasting to help you not only manage costs but also plan. You can view recommendations offered by Azure Advisor through Cost Management to further help you manage costs.

Service Level Agreements

A service level agreement (SLA) is an agreement between a service provider and a consumer that generally guarantees that the SLA-backed service will be available for a specific period during the month. SLAs are typically binding, financially backed agreements in which the provider either pays a penalty or provides a credit to the consumer for the period in which the SLA is not met. For example, if a provider offers a 99.9 percent SLA for a service, they are guaranteeing that the service will be unavailable no more than 43.2 minutes during the month, corresponding to downtime of no more than about 8.76 hours a year. For those Azure services for which Microsoft offers an SLA, Microsoft will provide a credit in any billing period in which a service fails its SLA.

> **NOTE** Microsoft does not issue SLA credits automatically. You must open a billing case to request an SLA or work with your CSP to obtain a credit.

> **TIP** SLAs are often referred to based on the number of digits in the SLA. An SLA of 99.9 percent is often referred to as "three nines." Likewise, a 99.99 percent SLA is referred to as "four nines" and corresponds to downtime of no more than 52.56 minutes per year.

Understanding and designing around Azure SLAs is important to ensure you receive appropriate credits when the SLAs are not met, but is equally important for designing your Azure solutions to meet your own business requirements. If you need a specific web app to be down no more than an hour per month, you should design the solution for the appropriate SLA (in this case, 99.9 percent). As you will learn in the section "Composite SLAs" later in this chapter, you must consider the individual SLAs for each component in your solution.

A key point to understand is the difference between *available* and *available at degraded performance*. If an Azure service is available but with degraded performance, it still meets the SLA. The service must be completely unavailable to fail the SLA and qualify for a service credit. For example, assume that identity services are affected and logon times for your users to Azure resources is significantly affected, but users are not prevented from logging in. This would not qualify as an SLA failure because the service is still available.

Different Azure resources have not only different SLAs, but also different *service credits*. The service credits associated with the SLA for a given service determine the credit you will receive when you or your CSP submits a credit request. Generally the higher the SLA, the lower the service credit will be. For example, a 99.99 percent SLA might have a service credit of 10 (equating to 10 percent), whereas a 99 percent SLA for the same service might have a service credit of 25 percent.

> **NOTE**   Free Azure products generally do not have any SLA associated with them.

The Azure Status portal is a great place to get information about ongoing incidents or outages and access status history. You can also set up notifications so that you receive alerts when a service-impacting event (SIE) occurs. As mentioned earlier, you need to submit a billing case with Microsoft to receive a credit, or if you work through a CSP, the CSP will typically manage the credit process for you.

Composite SLAs

Most Azure resources and services have a set SLA. Many solutions that you build in Azure, however, are composites of multiple Azure services. A *composite SLA* is the SLA that results from combining services with potentially differing SLAs. For example, assume that your solution includes two VMs, one Azure SQL Database instance, and one Azure Load Balancer instance. The VMs have an SLA of 99.9 percent, Azure SQL Database 99.99 percent, and Azure Load Balancer 99.99 percent. To determine the composite SLA, you simply multiply the SLA values for each resource:

$$0.999 \times 0.999 \times 0.9999 \times 0.9999 = 0.9978$$

The resulting composite SLA in this example is 99.78 percent. Why include the VMs twice when they have the same SLA? Both are points of failure with the possibility of affecting performance or availability, so both need to be factored into the equation.

When you are planning an Azure deployment, you should always do the math to understand the resulting composite SLA. If the composite SLA does not meet your business needs, either review the design to determine if the reduced SLA is sufficient or redesign the solution with appropriate resources that do have the SLAs needed to meet the requirement.

> **TIP**   Multiple factors can affect composite SLA. The disk type you choose for a VM, for example, changes the resulting SLA for the VM. For services that offer different tiers, choosing a higher tier will result in an SLA where none would otherwise apply or in an increased SLA.

Availability Zones

Another way to raise the SLA for a given solution in Azure is to design it with high availability in mind. This can sometimes be counterintuitive, however. For example, adding VMs to a solution to balance the load would add a measure of high availability to the solution. If one VM fails, the others can continue functioning, resulting in availability of the service but potentially with reduced performance. Because each VM's SLA gets factored into the

composite SLA, adding more VMs actually *lowers* the composite SLA. This is where availability zones come into play.

As explained in Chapter 2, an availability zone is a distinct physical location within an Azure region consisting of one or more physical data centers. Each zone has its own independent power, cooling, networking, and related services. If one zone goes down because of a localized event, other zones can continue to operate. Deploying instances of a VM across two or more availability zones raises the SLA for the VM from 99.9 percent to 99.99 percent. Factoring that into your composite SLA equation results in a higher composite SLA.

> You should not design your solutions for unrealistically high SLAs. You will never achieve 100 percent availability, at least not over a long period of time. Consider the business needs for the solution, determine the resulting *reasonable* availability expected, and design to that number. Do not make your solution more complex than it has to be to meet the business need.

Service Lifecycles

A *service lifecycle* determines how a product is released and supported. Azure provides two lifecycle phases: *preview* and *general availability (GA)*, explained in the following sections.

Preview

Azure features in the preview phase of their lifecycle are essentially in beta testing. Using preview features enables you to test out new Azure functionality. Features in preview are not guaranteed to be deployed to general availability (discussed in the next section). Preview features are also not subject to SLAs and the limited warranty outlined in the Online Service Terms. They may not be covered by support and might be subject to different security, compliance, and privacy commitments from Microsoft.

Most previews are *public previews* that are available to everyone who uses Azure. In some cases, Microsoft offers *private previews* to selected organizations by invitation.

General Availability

The next step after the preview phase for an Azure service is *general availability*. These services are subject to the published SLAs and other service terms and warranties defined by the Online Service Terms.

Moving the GA does not guarantee that a service will always be offered by Microsoft. Microsoft can and does deprecate and sunset services. The modern lifecycle policy governing Azure provides for a minimum of 12 months' notice before a GA feature is retired.

Summary

Previous chapters have focused mainly on explaining how Azure works and the various resources and services available in Azure. This chapter turned to lifecycle and cost management topics to help you understand how to plan your long-term Azure strategy, adapt to changing requirements and resource offerings, and plan and manage costs.

Before you deploy your solutions to Azure, ensure that you use the TCO Calculator to estimate the cost savings you will realize by moving your on-premises workloads and workloads hosted in other cloud services to Azure. Then, use the Pricing Calculator to estimate the cost more closely for each resource or solution that you intend to deploy.

Once you have deployed resources to Azure, use Azure Advisor to discover opportunities to reduce costs. Implementing spending limits, prepaying for services with Azure Reservations, deploying resources into different regions, and leveraging your existing licenses with Azure Hybrid Benefit can all result in cost savings.

Also, take the time to understand SLAs in Azure and the SLA associated with each resource or service. Consider the business need for each solution and the acceptable downtime, and then design the solution for an appropriate composite SLA. Consider using different service tiers and availability zones to improve composite SLAs for your solutions.

Finally, take into account the lifecycle of each service that you deploy in Azure. Monitor lifecycles of your solutions to determine if and when a service will be retired so that you can implement changes as needed.

Exam Essentials

Identify factors that can affect costs (resource types, services, locations, ingress and egress traffic).   Many factors can affect Azure costs. Each resource or service has specific costs that can vary according to its size, tier, or other factors. The location of a resource also potentially affects its cost. For example, network traffic between regions can incur additional charges that must be factored in when designing a deployment.

Identify factors that can reduce costs (Reserved instances, Reserved capacity, Hybrid use benefit, Spot pricing).   Azure provides several methods for reducing overall cost. Reserved instances enable you to prepay for services and receive a discount corresponding to the length of the commitment. Payment flexibility enables you to spread the commitment across the agreement to help shift from lump-sum payment to recurring operational cost. The Hybrid Use Benefit lets you bring your Windows Server and SQL Server licenses covered by Software Assurance into Azure to lower licensing costs. Other offers such as spot pricing and promotional offers can also help you reduce Azure costs.

Describe the functionality and usage of the Pricing Calculator and the Total Cost of Ownership (TCO) Calculator.   The TCO Calculator is intended to help you estimate the cost of moving workloads into Azure at a large scale. The TCO Calculator not only takes into

account the resources (such as VMs) but also factors in facilities and staffing cost to estimate the total cost to move a solution to Azure. When it comes time to move specific workloads into Azure, use the Pricing Calculator to estimate the costs associated with the specific resources that will comprise the solution.

Identify the purpose of an Azure service level agreement (SLA).   SLAs are agreements between Microsoft and you in regard to the availability of an Azure service. Many but not all Azure services have SLAs. When designing a solution, you must consider the composite SLA that results from the individual SLAs for each resource in the solution. Multiply the individual SLAs to determine the composite SLA for the solution.

Identify actions that can impact an SLA (for example, availability zones).   Choosing higher tiers or service levels for a given service can improve its SLA. For example, the type of storage you choose for a VM affects its SLA. Deploying VMs into two or more availability zones can increase the SLA for a VM or for the solution using those VMs. Consider these factors when planning for high availability.

Describe the service lifecycle in Azure (public preview and general availability).   The service lifecycle in Azure includes two phases: preview and general availability. Services in either public or private preview are not subject to SLAs or other terms in the Azure Online Service Terms. Services in general availability are subject to those terms. Microsoft provides a minimum of 12 months' notice before retiring a GA service.

Review Questions

1.   Which of the following is the first step in deploying services to Azure?

     A.   Choosing a storage tier

     B.   Purchasing the appropriate Azure resources

     C.   Creating an Azure subscription

     D.   None of the above

2.   You are deploying a new solution that requires four instances of Azure SQL Server in an existing subscription, and you receive a message that you need to increase the subscription limit to create these resources. Which option correctly describes how to increase the limit?

     A.   Modify the policy that is restricting you from creating the resource.

     B.   Use Azure Resource Manager to increase the limits.

     C.   You must create a new subscription and deploy the resources to it.

     D.   Open an online support case to have Microsoft increase the limit for you.

3.   Which of the following is *not* an option for purchasing Azure services?

     A.   Enterprise agreement

     B.   Cloud solution provider

     C.   Web Direct

     D.   Unified Support

4.   Which two of the following would potentially increase operational costs for an Azure solution that you have deployed?

     A.   The region in which the resources are deployed

     B.   The subscription in which the resources are deployed

     C.   The billing account used for the target subscription

     D.   Deploying resources across multiple regions

5.   You are the Director of Infrastructure for your organization, which currently has no Azure subscriptions. Your CIO has requested an estimate of how much your organization can save by moving its entire data center to Azure. Which of the following should you use for an initial overall estimate?

     A.   Azure Advisor

     B.   Pricing Calculator

     C.   TCO Calculator

     D.   Create an Azure subscription and use the Azure Estimator tool to model costs.

6.   Is the underlined portion of the following statement true, or does it need to be replaced with one of the other fragments that appear below?

     The Azure Pricing Calculator enables you to estimate the cost of a specific Azure solution based on the resources and services in that solution.

    A. can calculate the estimated cost of moving a data center to Azure.

    B. factors facilities costs such as power and cooling into an estimate.

    C. is a downloadable tool that can help you calculate the costs of deploying an Azure solution.

    D. No change is needed.

7. Which of the following use scenarios are appropriate for Azure Advisor? (Choose all that apply.)

    A. Determining ways to reduce costs

    B. Deploying security policies and initiatives based on recommendations from Microsoft

    C. Getting recommendations for improving security

    D. Viewing service health

8. Your organization completed a sizable Azure deployment over the past year encompassing compute, storage, big data, and serverless computing, with a relatively small DevOps component. As the IT Director, you have been tasked by the CIO with reducing Azure expenditures. You cannot reduce the resources you have deployed in Azure. Which option could provide the most significant cost savings?

    A. Reviewing and resizing VMs

    B. Moving resources to less expensive regions

    C. Using Azure reservations to prepay for services

    D. Moving from Azure SQL Database to Azure SQL Managed Instance

9. Which of the following is most likely to increase Azure operational costs?

    A. Adding another subscription

    B. Moving storage from the hot access tier to the archive tier

    C. Deploying connected resources across multiple regions

    D. None of the above

10. Is the underlined portion of the following statement true, or does it need to be replaced with one of the other fragments that appear below?

Azure Hybrid Benefit <u>is a cost-saving option offered by Microsoft for all Azure hybrid deployments</u>.

    A. enables you to leverage your existing Windows Server and SQL Server licenses that are covered by Software Assurance for deployments in Azure.

    B. reduces pricing for network ingress traffic from your on-premises data center to Azure in a hybrid deployment.

    C. enables you to leverage all your Microsoft perpetual licenses in Azure if those licenses are decommissioned in your on-premises data center.

    D. No change is needed.

11. Which of the following enables you to define budgets for your subscriptions and receive notifications when spending crosses alert thresholds that you have set?

    A. Azure Quota Management

    B. Azure Budget Management

    C. Azure Cost Management

    D. Azure Monitor

12. You are planning to deploy a solution in Azure that comprises two VMs, each of which has a 99.5 percent SLA, and one Azure SQL Database with a 99.99 percent SLA. Which of the following is the resulting composite SLA for this scenario?

    A. The lowest SLA value, 99.5 percent

    B. The highest SLA value, 99.99 percent

    C. The average of the three SLAs, or 99.97 percent

    D. The product of the three SLAs, or 98.99 percent

13. You have deployed several VMs into Azure and need to increase the SLA for the VMs to meet mandated business requirements. Which of the following would achieve that requirement?

    A. Adding more storage for the VMs

    B. Deploying additional instances of the VMs to two or more availability zones

    C. Increasing the number of VMs

    D. None of the above

14. Is the underlined portion of the following statement true, or does it need to be replaced with one of the other fragments that appear below?

An Azure service that is in public preview is <u>available to public customers by invitation from Microsoft</u>.

    A. available to all Azure customers.

    B. available only with an enterprise agreement.

    C. subject to SLAs.

    D. No change is needed.

15. Which of the following accurately describe Azure Services that are in private preview? (Choose all that apply.)

    A. They are available for all customers in the United States only.

    B. They are available for customers by invitation from Microsoft.

    C. They are generally not subject to SLAs.

    D. They are not guaranteed to move to general availability.

16. How much notice does Microsoft provide before it retires an Azure service?

    A. 30 days

    B. 6 months

    C. 12 months

    D. 5 years